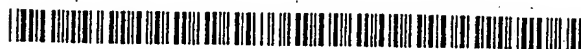


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**Published:**

- with international search report
- before the expiration of the time limit for amending the  
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For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: THERMALLY CONDUCTIVE ADHESIVE COMPOSITION AND PROCESS FOR DEVICE ATTACHMENT

(57) Abstract: Thermally conductive, sinterable, adhesive compositions, free of fugitive solvents, that include a powder of a relatively high melting point metal or metal alloy, a powder of a relatively low melting point metal or metal alloy powder and a thermally curable adhesive flux composition that comprises (i) a polymerizable fluxing agent; (ii) an inerting agent to react with the fluxing agent at elevated temperature, rendering it inert. The fluxing agent preferably comprises a compound with formula RCOOH, wherein R comprises a moiety having one or more polymerizable carbon-carbon double bonds. Optionally, the inventive compositions also include (a) a diluent that is capable of polymerizing with the fluxing agent's polymerizable carbon-carbon double bonds; (b) free radical initiators; (c) a curable resin; and (d) crosslinking agents and accelerators. The compositions can be applied directly onto the surfaces of devices to be joined mechanically and/or electrically and are ideally suited for semiconductor die attachment. During heating, the fluxing agent promotes wetting of the high melting point powder by the molten low melting point powder, causing liquid phase sintering of the powders. The fluxing agent also promotes wetting of the metallizations on the die and substrate by the molten low melting point alloy, providing improved thermal conductivity. Simultaneously, the fluxing agent itself crosslinks to further mechanically bond the adherent surfaces. The absence of fugitive solvents creates a void-free bond.

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/09886

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : C08K 03/08; C09J 04/02; 163/00, 163/02  
US CL : 252/183.11; 523/458

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
U.S. : 252/183.11; 523/458

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
CAS Online: Files REG and CAPLUS

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,985,456 A (ZHOU et al.) 16 November 1999 (16.11.1999), column 4, lines 14-18; column 8, lines 34-37 and column 9, lines 47-63.	1-3 and 5
A	PCT WO/8/08362 A1 (CRAIG) 26 February 1998 (26.02.1998), page 9, line 23 to page 10, line 4; page 12, lines 20-33 and page 14.	1-3 and 5
A	US 5,652,042 A (KAWAKITA et al.) 29 July 1997 (29.07.1997), column 2, lines 14-34.	1-3 and 5
A	US 6,458,472 A (KONARSKI et al.) 01 October 2002 (01.10.2002), column 4, lines 26-31 and column 5, lines 32-42.	1-3 and 5

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

### Special categories of cited documents:

- \* "A" document defining the general state of the art which is not considered to be of particular relevance
- \* "E" earlier application or patent published on or after the international filing date
- \* "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \* "O" document referring to an oral disclosure, use, exhibition or other means
- \* "P" document published prior to the international filing date but later than the priority date claimed

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- \* "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \* "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- \* "&" document member of the same patent family

Date of the actual completion of the international search

16 November 2004 (16.11.2004)

Date of mailing of the international search report

23 NOV 2004

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Facsimile No. (703) 305-3230

Authorized officer

Robert Sellers

Telephone No. (703) 308-1193

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/09886

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:  
An Invitation to Pay Additional Fees, Form PCT/ISA/206, setting forth a lack of unity of invention was mailed on 04 October 2004. No response has been received within the 15 day response period from the date of mailing. Accordingly, no additional fees have been paid and only the first invention of claims 1-5 is hereby considered.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-5

Remark on Protest ☐ The additional search fees were accompanied by the applicant's protest.  
☐ No protest accompanied the payment of additional search fees.

# PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:  
GARY M. NATH  
NATH & ASSOCIATES PLLC  
1030 15TH STREET NW, 6TH FLOOR  
WASHINGTON, DC 20005-1503

## PCT

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL SEARCH REPORT AND  
THE WRITTEN OPINION OF THE INTERNATIONAL  
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 90078PCT	Date of mailing (day/month/year) <b>23 NOV 2004</b>
International application No. PCT/US04/0.886	International filing date (day/month/year) <b>23 NOV 2004 (30.03.2004)</b>
Applicant AGUILA TECHNOLOGIES, INC.	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

**Filing of amendments and statement under Article 19:**

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

**When?** The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

**Where?** Directly to the International Bureau of WIPO, 34 chemin des Colombettes  
1211 Geneva 20, Switzerland, Facsimile No.: +41 22 740 14 35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

**4. Reminders**

Shortly after the expiration of 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

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Form PCT/ISA/220 (January 2004)

(See notes on accompanying sheet)

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